

CLEANING OF FISH ECTOPARASITES BY A PALAEMONIDAE SHRIMP ON SOFT BOTTOMS IN NEW CALEDONIA. Michel KULBICKI, ORSTOM B.P. A5, Nouméa, NOUVELLE-CALÉDONIE & Céline ARNAL, Université de Perpignan, Laboratoire de Biologie Animale, CNRS UMR5555, 66860 Perpignan cedex, FRANCE.

RÉSUMÉ. - Un comportement de nettoyage a été observé chez une crevette du genre *Periclimenes*, à proximité d'une anémone du genre *Actinodendron* sur des fonds meubles dans le port de Nouméa (Nouvelle-Calédonie). Un poisson coffre (*Tetrosomus gibbosus*) était nettoyé par cette crevette. Cette observation est originale, d'une part, parce qu'elle avait lieu sur des fonds meubles éloignés de toute influence récifale, d'autre part, parce que c'est la première observation dans cette région d'une activité de ce type par une crevette *Periclimenes*.

Key-words. - Crustacea, *Periclimenes*, ISEW, New Caledonia, Cleaning behavior.

Fish harbor many ectoparasites. On tropical reefs there are many known associations involving a cleaning organism removing ectoparasites from the body of a "client" fish (see reviews in Losey, 1987; Poulin and Grutter 1996). The cleaning organisms are usually fish or crustaceans (Van Tassel *et al.*, 1994). Among the Indo-Pacific fish, cleaner wrasses of the genus *Labroides* are the best illustrated examples (Losey, 1972; Itzkowitz, 1979; Lejeune and Voss, 1980; Grutter, 1996; Henriques and Almada, 1997). They are even mimiced by blennies of the genus *Aspidontus*, which take advantage of the confidence fish have in *Labroides* to bite flesh off their victims (Randall *et al.*, 1998). Several shrimps are also known to clean fish. Among them *Stenopus hispidus*, which occurs worldwide, is probably the best example in the tropical Pacific along with the genus *Lysmata*, and *Periclimenes* shrimps are well known in the tropical Atlantic (see Van Tassel *et al.*, 1994 for review). Cleaning behaviours are, however, known only from reef areas and, to our knowledge, cleaning associations from tropical soft bottom areas are undescribed.

The present note brings attention to the cleaning behaviour of a palaemonid shrimp of the genus *Periclimenes*. The shrimp could not be captured but it was pictured (Fig. 1). Illustration of extremely similar species can be found as *Periclimenes* sp. in Gosliner *et al.* (1996, p. 206) or in Steene (1990, p. 167, bottom picture). The largest specimen observed is approximatively 3.5 cm long (from rostrum to tail). The shrimp was observed in a large stinging sea anemone (approximatively 40 cm in diameter and 30 cm high) of the genus *Actinodendron*. Cleaning shrimps are known to live in or around sea anemones (Johnson and Ruben, 1988; Van Tassel *et al.*, 1994; Wicksten, 1998). The shrimps are usually within the tentacles and difficult to spot because their body is translucent and the whitish spots on their body imitate, somewhat, the knob-like vesicles of the anemone. The observations were made on muddy bottoms at a depth of 10 m in the main harbor of Nouméa (New Caledonia) and later in a sea-grass bed nearby at a depth of 3 m. On the first station, a box fish, *Tetrosomus gibbosus*, of approximatively 20 cm, approached the anemone and rested on the bottom at about 50 cm from the tentacles, staying sideways. The shrimp crept toward the fish and cleaned the top of its head and around the mouth, and then returned to the anemone. Following to this first observation, we searched for other anemones with this shrimp. Several anemones were found but only one out of 10, among sea grass, was inhabited by this shrimp. The observer approached very slowly and left his hand at about 30 cm from the anemone. The largest shrimp (approx. 3 cm) performed a « dance ». First it rapidly waived its claws sideways. Then it came out of the anemone, swimming sideways and rocking its body. It landed on the finger of the observer and started "cleaning" (Fig. 1). The smaller shrimps (approx. 1.5 cm) left in the anemone also performed the claw waiving display, but did not venture out of the tentacles. The largest shrimp cleaned the hand of the diver again within 2 minutes, thus showing that it did not learn to recognise the diver's hand as something different from a fish.

Cleaning in the soft bottom habitat has not been described in the past. This type of behaviour in such an habitat is probably rare because cleaning interactions occur usually over hard substrates (Johnson and Ruben, 1988; Grutter 1996;



Fig. 1. - *Periclimenes* sp. in a resting position on an anemone (top) and while "cleaning" the hand of the author (bottom). Pictures by Jean Grimaud.

Arnal and Côté, 1998). In addition, most fish on soft bottoms are not site attached, except for gobies, which in turn are usually dependent on, and remain close to, a burrow for protection. However, the present observation has many points in common with the cleaning observed on reefs. The cleaning shrimp belongs to the genus, *Periclimenes*, which is known to clean fish in the Caribbean (Sargent and Wagenback, 1975; Johnson and Ruben, 1988; Wicksten, 1998) or in the eastern Pacific (Kerstitch, 1989) but not in the western Pacific with the exception of *Leandrites cyrtorhynchus* (Van Tassel *et al.*, 1994). However, this shrimp genus is very diversified in the Pacific and is usually a commensal of invertebrates such as coral, sea anemones, crinoides, black coral or even holothurians (Colin and Arneson, 1995). The cleaning behavior of this shrimp is somewhat different from the observation made on the same genus in the Caribbean (Wicksten 1998). However, this latter author, as in the present observation, noticed that these shrimps would clean unrealistic « fish » such as fish decoys or human hands. Therefore, it looks as if these shrimps are not particularly sensitive to clues from their clients, except that the latter have to approach and stay motionless. Studies on cleaner wrasses revealed that they may be more or less specialised in cleaning according to the available food (Grutter, 1997a). The same cleaner fish species, depending on where it lives, will either feed exclusively on ectoparasites from its client fish body or find a major part of its diet in benthic organisms (Grutter, 1997 b). Thus, cleaner shrimps could also be capable of such adaptative processes.

The *Actinodendron* anemones are sedentary. Their foot is fixed in a burrow into which the animal retracts if disturbed. It acts therefore as a fixed point in an otherwise rather homogeneous horizon of soft bottom. The shrimp gains not only protection from this stinging anemone, but the anemone may serve as a landmark for fish and enable them to find these shrimps which are otherwise very difficult to spot. This can be compared to the fact that on reefs cleaner fishes live in a small territory, a cleaning station where cleaning interactions typically occur (Youngbluth, 1968; Gorlick *et al.*, 1978; Côté *et al.*, 1999). Cleaner fishes display their presence to client fish by a special swimming behaviour (Potts, 1973; Lemaire and Maigret, 1987; Arnal and Côté, 1998). In the same way, the *Stenopus hispidus* shrimp usually stays in a fixed place and may perform a

"dance" to attract client fishes (Sargent and Wagenback, 1975). However, in the present observation, one may wonder how good a fish attractor the anemone may be. Indeed, this genus of anemone is very efficient at catching fish and is usually avoided by most fish. When this anemone occurs near a reef, even chaetodontids, which will often prey on anemones, will not touch it. The present observation suggests that there is an ecological convergence in the need of territoriality for cleaning organisms, shrimps as well as fish.

REFERENCES

- ARNAL C. & I.M. CÔTÉ, in press. - Interactions between cleaning gobies and territorial damselfishes on coral reefs. *Anim. Behav.*
- COLIN P.L. and C. ARNESON, 1995. - Tropical Pacific Invertebrates. 296 p., Beverly Hills (California): Coral Reef Press.
- CÔTÉ I.M., ARNAL C. & J.D. REYNOLDS, in press. Variation in posing behaviour among fish species visiting cleaning stations. *J. Fish Biol.*
- GORLICK D.L., ATKINS P.D. & G.S. LOSEY, 1978. - Cleaning stations as water holes, garbage dumps and sites for the evolution of reciprocal altruism. *Am. Nat.*, 112(984): 341-353.
- GOSLINER T.M., BEHRENS D.W. & G.C. WILLIAMS, 1996. - Coral Reef Animals of the Indo-Pacific. 314 p. Sea Monterey (California): Challengers Press..
- GRUTTER A.S., 1996. - Parasite removal rates by the cleaner wrasse *Labroides dimidiatus*. *Mar. Ecol. Prog. Ser.*, 130: 61-70.
- GRUTTER A.S., 1997a. - Size-selective predation by the cleaner fish *Labroides dimidiatus*. *J. Fish Biol.*, 50: 1303-1308.
- GRUTTER A.S., 1997b. - Spatiotemporal variation and feeding selectivity in the diet of the cleaner fish *Labroides dimidiatus*. *Copeia*, 1997(2): 346-355.
- HENRIQUES M. & V.C. ALMADA, 1997. - Relative importance of cleaning behaviour in *Centrolabrus exoletus* and other wrasse at Arrabida, Portugal. *J. Mar. Biol. Ass.*, 77: 891-898.
- ITZKOWITZ M., 1979. - The feeding strategies of a facultative cleanerfish: *Thalassoma bifasciatum* (Pisces: Labridae). *J. Zool.*, Lond., 187: 403-413.

- JOHNSON W.S. & P. RUBEN, 1988. - Cleaning behavior of *Bodianus rufus*, *Thalassoma bifasciatum*, *Gobiosoma evelynae*, and *Periclimenes pedersoni* along a depth gradient at Salt River Submarine Canyon, St Croix. *Env. Biol. Fish.* 23(3): 225-232.
- KERSTITCH A., 1989. - Sea of Cortez marine Invertebrates. 114 p. Monterey (California): Sea Challengers.
- LEJEUNE P. & J. VOSS, 1980. - Observation in situ des comportements agonistiques territoriaux et reproducteurs du poisson nettoyeur méditerranéen *Syphodus (Crenilabrus) melanocercus* (Risso, 1810). *Ann. Inst. Océanogr.*, 56(1): 5-12.
- LEMAIRE P. & J. MAIGRET, 1987. - Importance relative des différents stimuli dans le comportement de nettoyage de *Labroides dimidiatus* (Cuv. et Val., 1839). *Ann. Inst. Océanogr.*, 63(1): 69-84.
- LOSEY G.S., 1972. - The ecological importance of cleaning symbiosis. *Copeia*, 1972(4): 820-833.
- LOSEY G.S. Jr., 1987. - Cleaning symbiosis. *Symbiosis*, 4: 229-256.
- POTTS G.W., 1973. - The ethology of *Labroides dimidiatus* (Cuv. & Val.) (Labridae, Pisces) on Aldabra. *Anim. Behav.*, 21(2): 250-291.
- POULIN R. & A.S. GRUTTER, 1996. - Cleaning symbioses: Proximate and adaptive explanations. *Bioscience*, 46: 512-517.
- RANDALL J.E., ALLEN G.R. & R.C. STEENE, 1998. - Fishes of the Great Barrier Reef and Coral Sea. 557 p. Australia: Crawford House Publishing Co - Bathurst.
- SARGENT R.C. & G.E. WAGENBACH, 1975. - Cleaning behavior of the shrimp, *Periclimenes anthophilus* Holthuis & Eibl-Eibesfeldt (Crustacea: Decapoda: Natantia). *Bull. Mar. Sci.* 25: 466-472.
- STEEENE R., 1990. - Mers de Corail. 336 p. Grenoble (France): Glénat Édit.
- VAN TASSEL J.L., BRITO A. & S.A. BORTONE, 1994. - Cleaning behavior among marine fishes and invertebrates in the Canary Islands. *Cybium*, 18(2): 117-127.
- WICKSTEN M.K., 1998. - Behaviour of cleaners and their client fishes at Bonaire, Netherland Antilles. *J. Nat. Hist.*, 32: 13-30.
- YOUNGBLUTH M.J., 1968. - Aspect of the ecology and ethology of the cleaning fish, *Labroides phthirophagus*, Randall. *Z. Tierpsychol.*, 25: 915-932.

Reçu le 03.08.1998.

Accepté pour publication 05.01.1999.